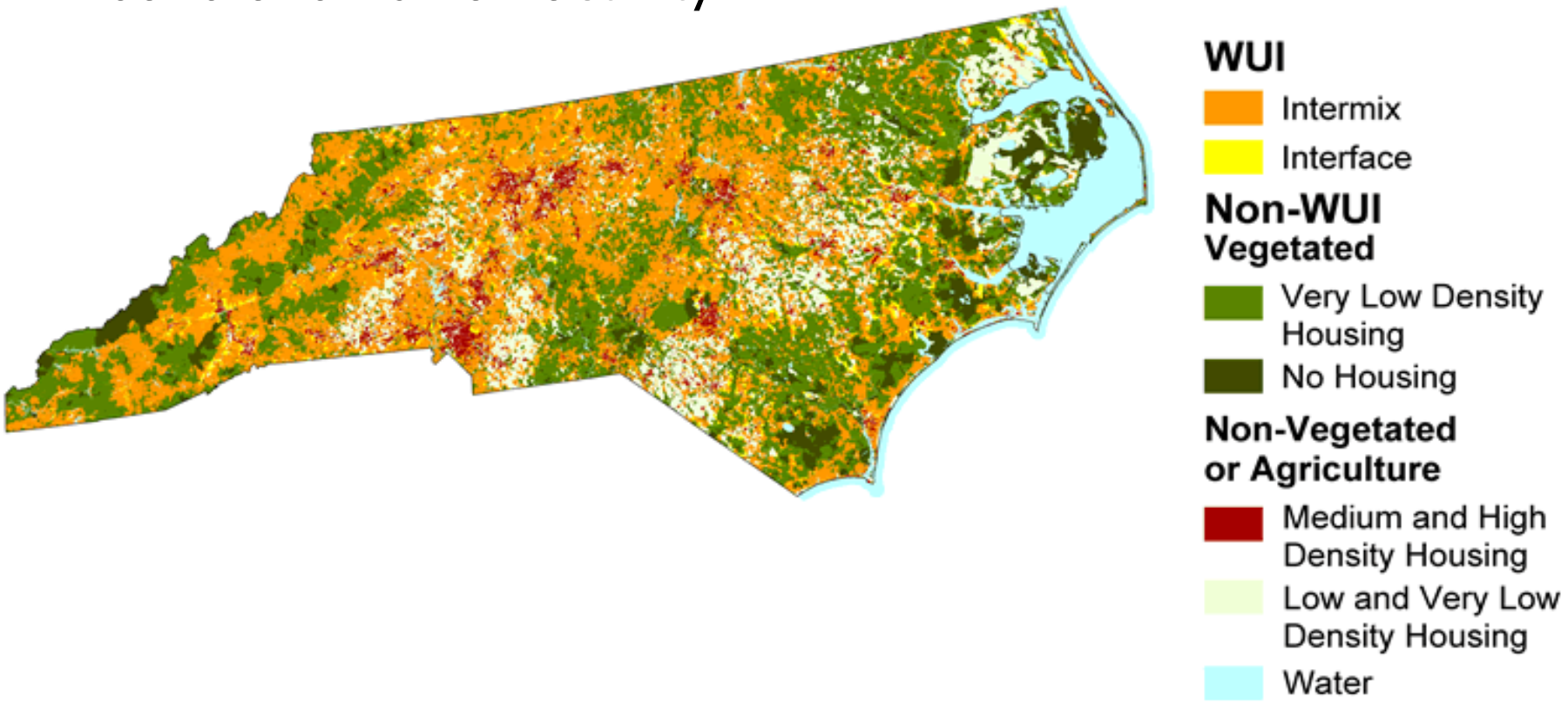
Superfog – Where Will It Happen Next

Jeff Orrock

Warning Coordination Meteorologist

- NC has an enormous wildland urban interface. Here wildland urban interface is defined as the interface between the wildand and human activity.



Massive Pileup on Interstate 4
January 8th 2008

Near Lakeland, FL

The Headlines Read…

January 8, 2008

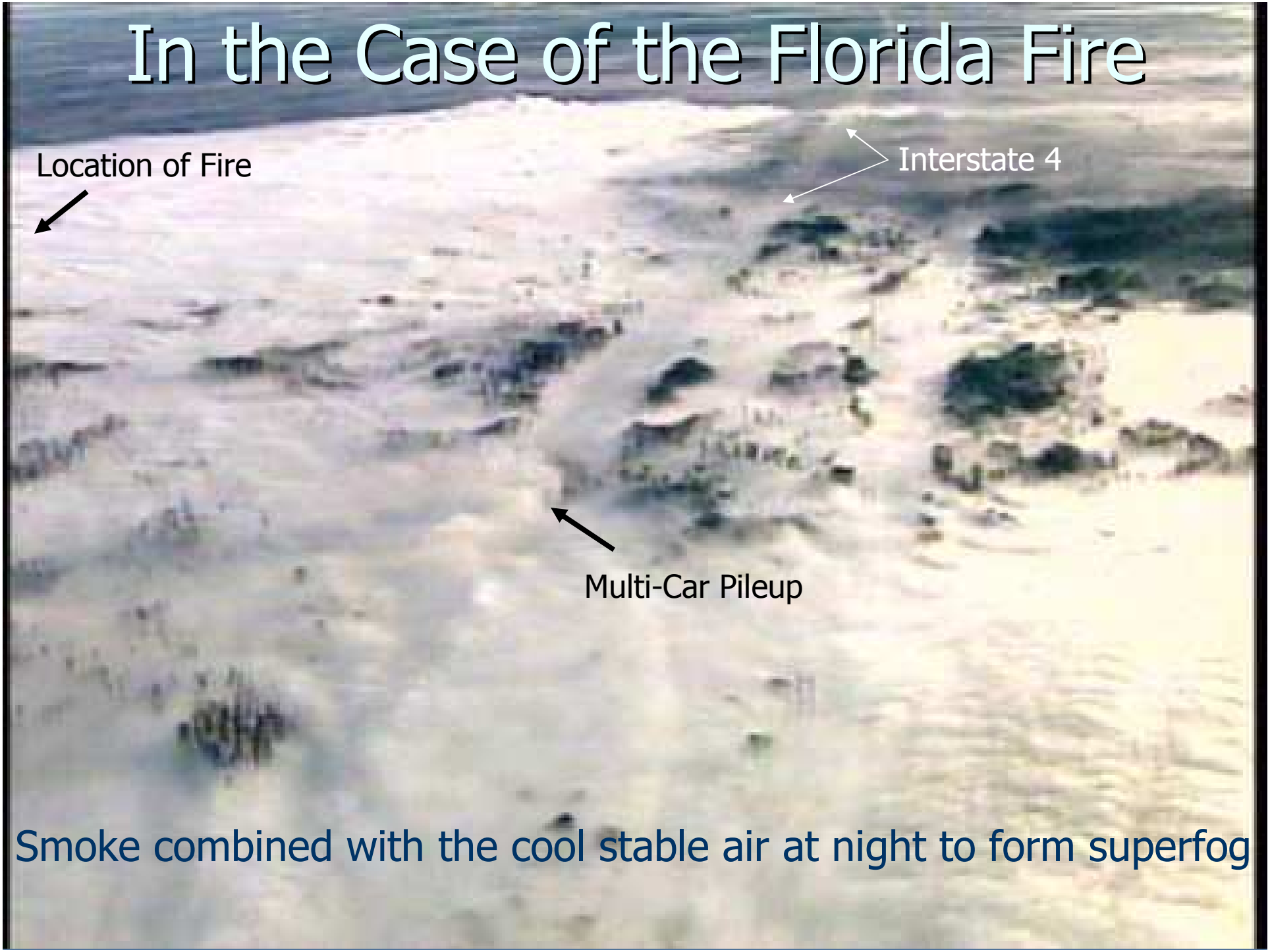
Prescribed Burn Goes Wild, Fire Chars 250 Acres

The Morning After…

January 9, 2008

4 Dead, 38 Injured in Crashes Along Foggy, Smokey Highway

In the Case of the Florida Fire



Smoke combined with the cool stable air at night to form superfog


Fog was Exceptionally Dense
Result was Disastrous


Superfog Looks Like This
Reduces Visibility to 1 to 3 meters

Can be tens of meters deep

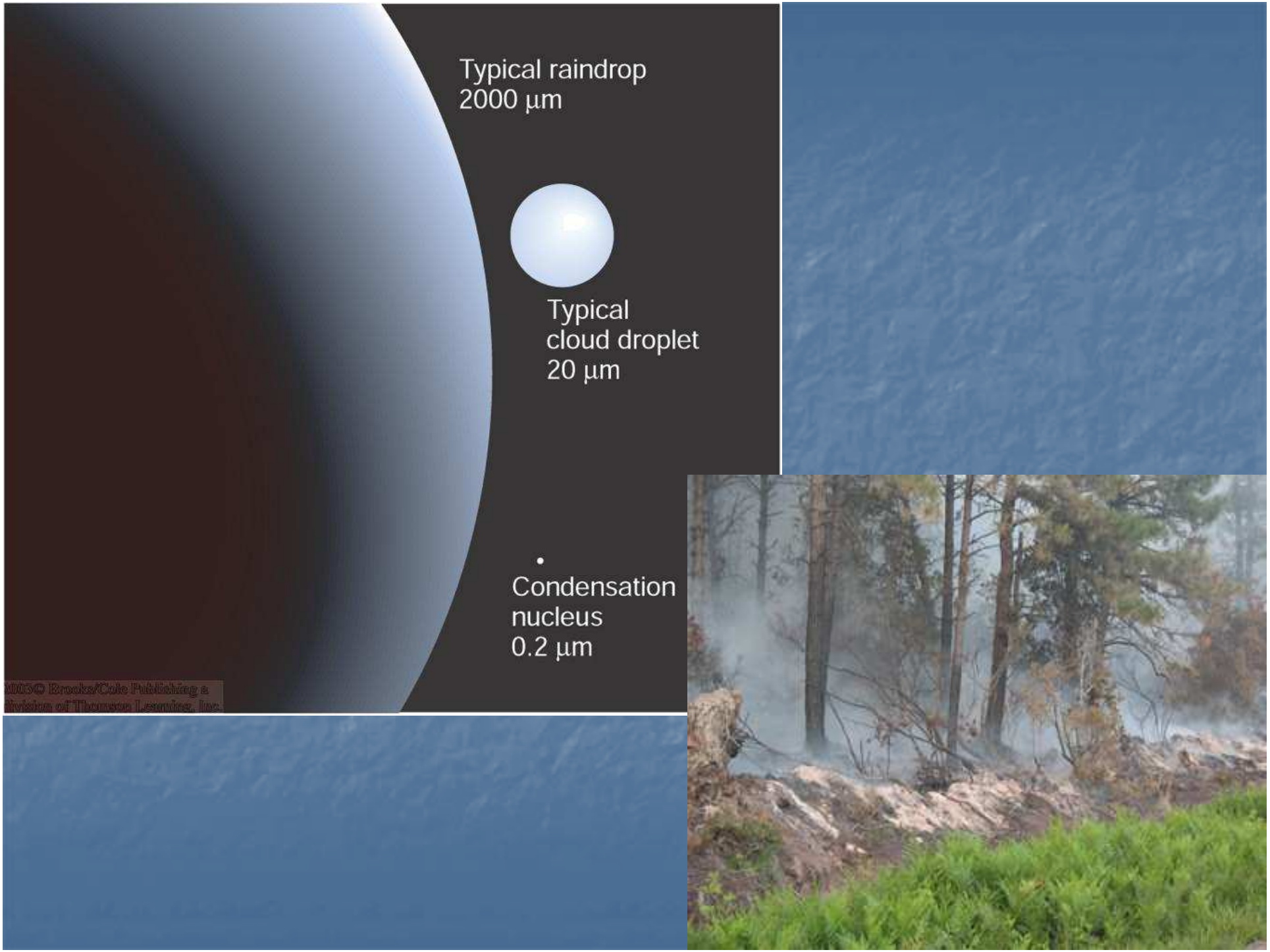
Dense Smoke hypothesis #1

- Holds that Superfog is not fog but dense smoke.
- If the daytime mixing height is 1000 m and the nighttime mixing height is 10 m, the mixing height is reduced 100%.
- Additionally if the daytime transport wind speed is 10 m/sec and the nighttime transport wind speed is 1 m/sec, then the transport wind no longer spreads out the smoke.
- According to the dense smoke hypothesis, **stable, near-calm weather during night, can create conditions favorable for dense ground level smoke concentrations.**

Nighttime Inversion
(caps the atmosphere and reduces mixing)

The hygroscopic nuclei hypothesis

- This theory holds that smoldering smoke contains an enormous number of hygroscopic particles **- particles that have an affinity for water and assist in the formation of small water droplets.**
- The **relative humidity is higher at night** and in low lying areas or valleys. In addition, **local moisture sources such as streams, lakes, and standing water contribute moisture to the airmass increasing the relative humidity.**
- When the relative humidity approaches 100 percent, the hygroscopic particles in smoke assist the formation of fog.
- Smoke enhanced fog - Superfog.


Typical raindrop
2000 μm
Typical
cloud droplet
20 μm
Condensation
nucleus
0.2 μm
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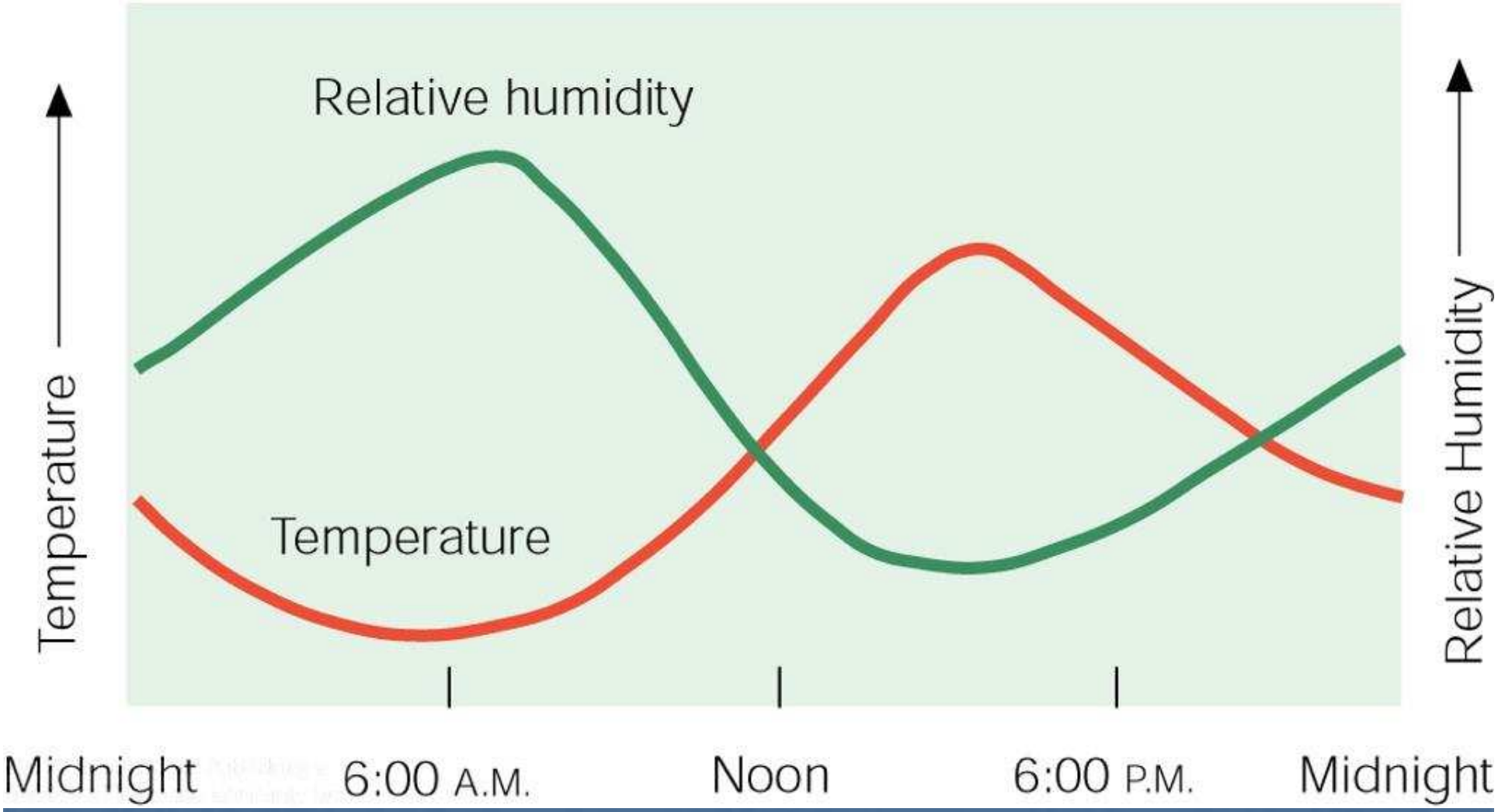
Humidity (Daily Fluctuation)



Moisture Excess Hypothesis

- The moisture excess theory holds that **large amounts of moisture are released at high temperature in smoke from smoldering logs and stumps.**
- Once released, this **"moist smoke" cools rapidly to supersaturation and dense fog - Superfog - forms.**
- Mixing with the cooler ambient air will either maintain the Superfog if the ambient air is sufficiently moist or dissipate the Superfog if the ambient air is dry.

How Superfog Forms

- As smoldering burns downward into increasingly wetter fuels, large amounts of water vapor are boiled off at high temperature.

- Upon reaching the surface, the hot, wet air cools rapidly – the humidity rapidly goes to 100% -and the moisture flashes into a super dense fog.

- The super dense fog will persist if the surrounding air is already moist

- Gary Achtemeier

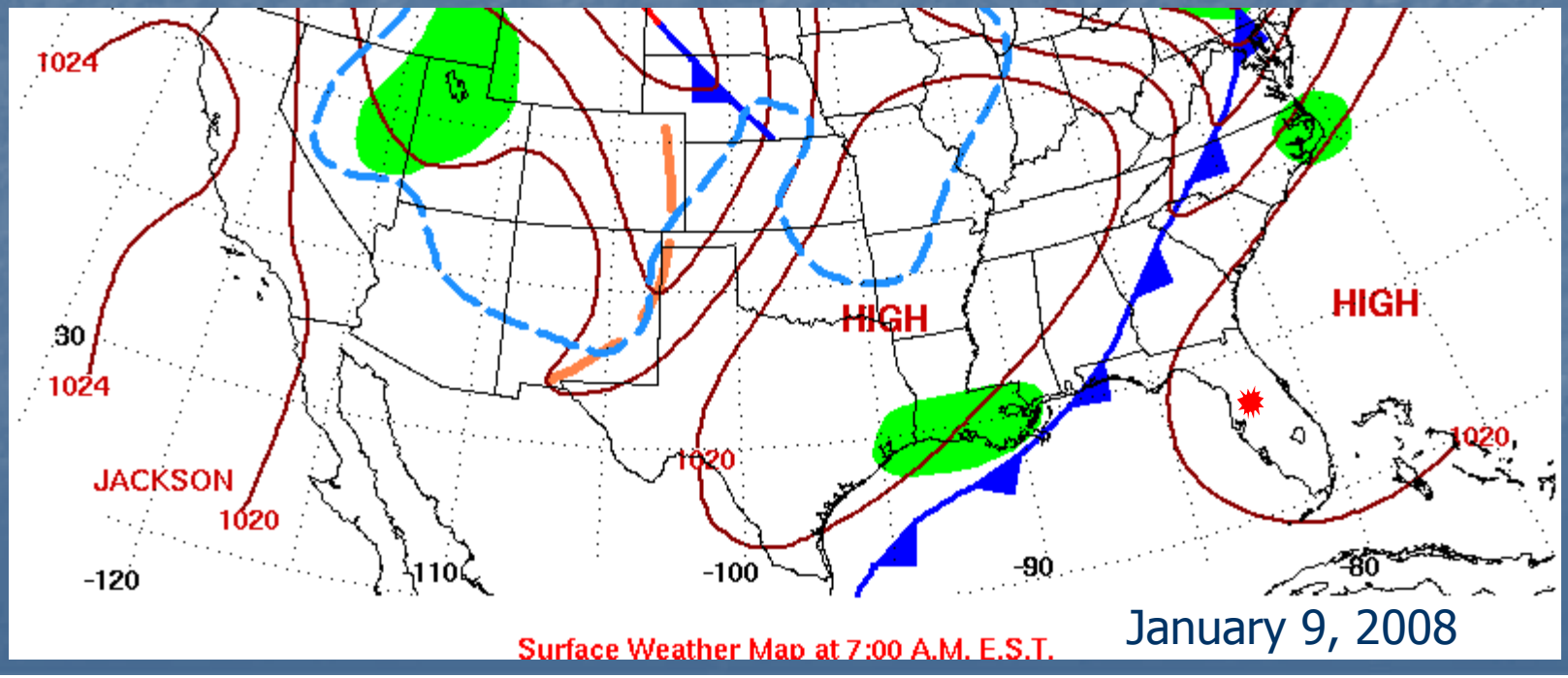
- Evans Road Fire, NC

Keeping This Disastrous Motivation In Mind… What Can We Do To Mitigate?

- Situational Awareness
- Recognize weather patterns that promote the formation of dense fog
- Staffing
- Increase public awareness
- Warnings when appropriate

Weather Patterns that favor dense fog formation…

- High pressure centered overhead
- Light or calm winds
- Clear skies




Superfog


Is Real!

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